72-55

614

Branch of Forest Insect and Disease Prevention and Control
Division of Timber Management
Region Four Forest Service
U.S. Department of Agriculture
Ogden, Utah

May 1972

Trend and Impact of the Mountain Pine Beetle on Stand Structure near Spring Creek Park, Bridger National Forest

Prepared by: Lawrence Stipe

Lawrence Stipe, Entomologist
Section of Insect Detection and Evaluation

LIBRARY FILE

INTRODUCTION

The following is a report on a study established to measure yearly attrition and impact on stand structure during a mountain pine beetle, Dendroctonus ponderosae Hopkins, epidemic in lodgepole pine. For many years, there has been a need for trend and impact data during a bark beetle outbreak in lodgepole pine in Region 4. To fill this need, a study was initiated in 1968 in an uncontrolled infestation in Yellowstone National Park 1/. Since these data were relevent only to Yellowstone and other similar stands, a companion study was initiated in 1970 in a stand with far different stand characteristics. The new study area was dissimilar in stand structure, stand composition, and elevation from the Yellowstone study area.

The area selected for this study is located on the West Slope of the Wind River Range near Spring Creek Park, Bridger National Forest, Wyoming (Figure 1). The area covers approximately 400 acres of forested land at a mean elevation of 8,800 feet. No bark beetle control work or timber harvest has been undertaken in this area nor are they planned.

The West Slope of the Wind River Range has a long history of mountain pine beetle-caused mortality in lodgepole pine. The current infestation began during the early 1960's. Initially, small groups of "faders" were observed in the lower elevation, fringe-type stands. The infestation intensified at the lower elevations and then spread into susceptable timber at higher elevations. In most of these high elevation stands, the infestations have peaked and are now on the decline.

METHODS

During spring of 1970, 85 permanent variable plots were established in a systematic grid pattern at seven chain intervals. During the initial cruise, green stand data were recorded on every other plot on every other cruise line (26 plots), using a basal area factor (BAF) of 10. Mountain pine beetle-caused mortality was recorded on all 85 plots using BAF of 5 and tallied in one of three categories: currently infested trees (1969 attacks), "faders" (1968 attacks), and previous mortality (1967 and before). Only trees greater than 5.0 inches d.b.h. were recorded.

1/ Parker, D. L. 1971. Mountain Pine Beetle Trend and Impact Study Yellowstone National Park. 4pp., typed.

RESULTS AND DISCUSSION

The green stand structure prior to the bark beetle infestation was reconstructed using green stand and mortality data from the original cruise. A resume of the green stand structure prior to the infestation follows:

Tree Species	Green Stems/Acre Diameter Classes								
	6	8	10	12	14	16	≥ 16	Total	Percent of Stand
Lodgepole pine	33.60	49.92	39.48	40.82	29.81	15.32	10.91	219.86	84.0
Limber pine	-	8.22	5.75	2.49	1.67	1.42	1.58	21.13	8.1
TOTAL HOST	33.60	58.14	45.23	43.31	31.48	16.74	12.49	240.99	92.1
Douglas-fir	9.79	1.10	3.53	-	0.72	-	0.22	115.36	5.9
Subalpine	--	-	0.71	-	0.36	-	-	1.07	0.4
Engelmann spruce	1.96	1.10	-	-	0.36	-	0.87	4.29	1.6
TOTAL NONHOST	11.75	2.20	4.24	-	1.44	-	1.09	20.72	7.9
TOTAL STAND	45.35	60.34	49.47	43.31	32.92	16.74	13.58	261.71	100.0

During the infestation, 21.82 lodgepole pine and 2.54 limber pine per acre have been killed by the mountain pine beetle. Since mortality could only be post dated back to 1968, the trend during the formative stage of the infestation is unknown. However, aerial survey data show "faders" in this area in 1966 (1965 attacks). Lodgepole pine mortality in trees per acre was 2.03 in 1968, 4.41 in 1969, 6.62 in 1970, and 2.79 1/ in 1971 (Figure 2). Limber pine mortality occurred at a much lower level and was 0.85 in 1968, 0.75 in 1969, 0.60 in 1970, and 0.25 1/ in 1971 (Figure 2). These loses represent 9.3 percent of the stand, 9.9 percent of the lodgepole pine, and 12.0 percent of the limber pine. A summary of yearly mortality by diameter classes follows:

1/ Subject to correction in 1972.

Year	Dead Lodgepole Pine/Acre Diameter Classes								
	6	8	10	12	14	16	>16	Total	Accum. Mort.
1967	0.30	0.34	0.97	1.20	1.10	1.10	0.97	5.98	5.98
1968	-	-	0.11	0.60	0.44	0.38	0.50	2.03	8.01
1969	-	-	0.32	0.82	1.65	0.89	0.73	4.41	12.42
1970	-	0.17	0.43	1.57	1.71	1.31	1.43	6.62	19.04
1971	-	-	0.22	0.97	0.72	0.38	0.50	2.79	21.83
Total	0.30	0.51	2.05	5.16	5.62	4.06	4.13	21.83	

Year	Dead Limber Pine/Acre Diameter Classes								
	6	8	10	12	14	16	>16	Total	Accum. Mort.
1967	-	-	-	-	0.06	-	0.03	0.09	0.09
1968	-	0.51	-	0.23	-	0.04	0.07	0.85	0.94
1969	-	-	0.11	0.30	0.17	-	0.17	0.75	1.69
1970	-	-	0.11	-	0.11	0.21	0.17	0.60	2.29
1971	-	-	0.22	-	-	-	0.03	0.25	2.54
Total	-	0.51	0.44	0.53	0.34	0.25	0.47	2.54	

Peak lodgepole pine mortality occurred in 1970 and was followed by a decrease in 1971. A further decrease is expected in 1972. Limber pine mortality peaked in 1968 and has decreased each year since.

The inverse relationship between the occurrence of the various diameter trees and percent mortality is clearly illustrated by these data. Even though the larger trees make up a small portion of the stand in trees per acre, their rate of mortality is much greater than the smaller trees. These characteristics follow:

	Diameter Classes							
	6	8	10	12	14	16	>16	Total
Percent of lodgepole pine	15.3	22.7	17.9	18.6	13.6	7.0	4.9	100
Percent dead	0.9	1.0	5.2	12.6	18.9	26.5	37.9	9.9
Percent of limber pine	-	38.9	27.2	11.8	7.9	6.7	7.5	100
Percent dead	-	6.2	7.7	21.3	20.4	17.6	29.7	12.0

A statistical summary of between plot variation for the number of trees per acre follows:

Green Stand [a/]	Mean [b/]	Standard Deviation	Sampling Error(%)
Lodgepole pine	207.4	157.5	14.9
Limber pine	19.4	38.1	38.7
Nonhost Species	20.7	33.9	32.1
Total Green	247.6	169.0	13.4
Lodgepole pine Mortality [c/]			
1967	6.0	11.6	21.1
1968	2.0	5.2	27.9
1969	4.4	10.9	27.0
1970	6.6	15.3	25.1
1971	2.8	7.9	30.9
Limber pine Mortality [c/]			
1967	0.1	0.6	72.4
1968	0.8	7.3	95.1
1969	0.7	4.8	70.3
1970	0.6	3.1	57.2
1971	0.2	2.0	87.5

a/ Based on 26 green stand plots and represent green stand in spring 1969.

b/ Numbers have been rounded.

c/ Based on 85 plots.

The statistical parameters summarized above illustrate the variability found in a lodgepole pine stand and associated mountain pine beetle-caused mortality. Although variation was high, these data are useful in estimating population trend and impact. These types of trend and impact information are useful to land managers in adjusting management programs in infested stands in such a way as to minimize losses.

Not only does the structure and composition of this stand differ from that in Yellowstone Park, but the level of mortality as well. Overall mortality in Spring Creek Park is only 12 percent, while that in Yellowstone reached 26 percent. Just 2 miles to the north, near Willow Lake, some 45 percent of the stand was killed. 1/ There are several factors which may have influenced the rate of mortality, but the individual effect of each is unknown. Collectively, however, factors such as stand structure and composition, elevation, stand age and vigor, phloem quality and quantity, and parasite-predator populations have reduced tree killing far below its potential level.

Data collection will continue until the infestation subsides.

1/ Forest Insect Conditions on the Bridger National Forest, 1969.

APPENDIX

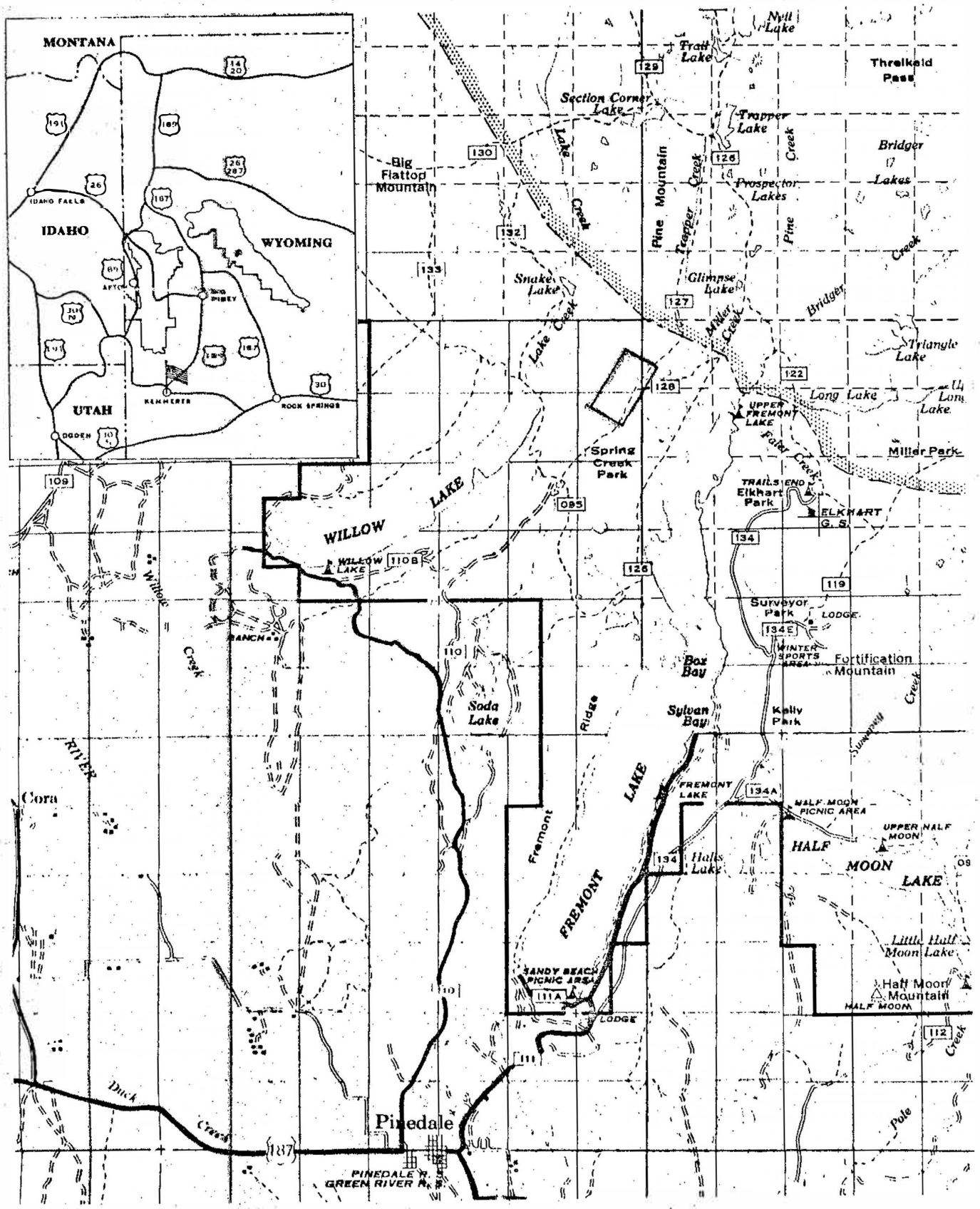

Figure 1. Location of study area near Spring Creek Park, Bridger National Forest, Wyoming.

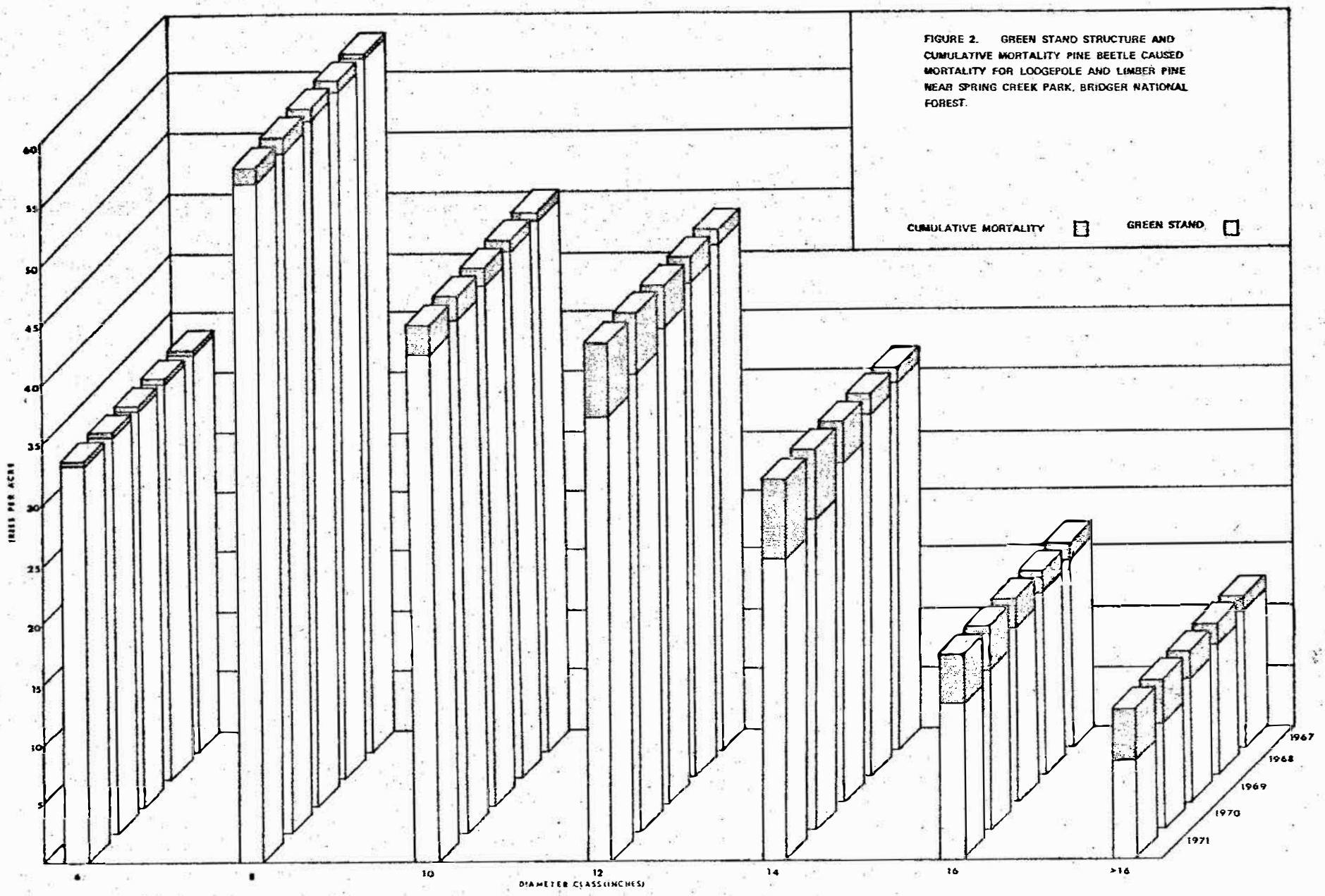
FIGURE 2. GREEN STAND STRUCTURE AND CUMULATIVE MORTALITY PINE BEETLE CAUSED MORTALITY FOR LODGEPOLE AND LIMBER PINE NEAR SPRING CREEK PARK, BRIDGER NATIONAL FOREST.
CUMULATIVE MORTALITY
GREEN STAND
TREES PER ACRE
60
55
50
45
40
35
30
25
20
15
10
5
6
8
10
12
14
16
>16
DIAMETER CLASS (INCHES)
1967
1968
1969
1970
1971